

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary, Advanced Level and AICE

MARK SCHEME for the June 2005 question paper

9709/0390 MATHEMATICS

9709/06, 0390/06

Paper 6, maximum raw mark 50

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which Examiners were initially instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began. Any substantial changes to the mark scheme that arose from these discussions will be recorded in the published *Report on the Examination*.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes must be read in conjunction with the question papers and the *Report on the Examination*.

- CIE will not enter into discussion or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the June 2005 question papers for most IGCSE and GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses'.



Grade thresholds for Syllabus 9709/0390 (Mathematics) in the June 2005 examination.

	maximum mark available	minimum mark required for grade:		
		A	B	E
Component 6	50	39	35	20

The thresholds (minimum marks) for Grades C and D are normally set by dividing the mark range between the B and the E thresholds into three. For example, if the difference between the B and the E threshold is 24 marks, the C threshold is set 8 marks below the B threshold and the D threshold is set another 8 marks down. If dividing the interval by three results in a fraction of a mark, then the threshold is normally rounded down.

Mark Scheme Notes

Marks are of the following three types:

- M Method mark, awarded for a valid method applied to the problem. Method marks are not lost for numerical errors, algebraic slips or errors in units. However, it is not usually sufficient for a candidate just to indicate an intention of using some method or just to quote a formula; the formula or idea must be applied to the specific problem in hand, e.g. by substituting the relevant quantities into the formula. Correct application of a formula without the formula being quoted obviously earns the M mark and in some cases an M mark can be implied from a correct answer.
 - A Accuracy mark, awarded for a correct answer or intermediate step correctly obtained. Accuracy marks cannot be given unless the associated method mark is earned (or implied).
 - B Mark for a correct result or statement independent of method marks.
- When a part of a question has two or more "method" steps, the M marks are generally independent unless the scheme specifically says otherwise; and similarly when there are several B marks allocated. The notation DM or DB (or dep*) is used to indicate that a particular M or B mark is dependent on an earlier M or B (asterisked) mark in the scheme. When two or more steps are run together by the candidate, the earlier marks are implied and full credit is given.
 - The symbol \surd implies that the A or B mark indicated is allowed for work correctly following on from previously incorrect results. Otherwise, A or B marks are given for correct work only. A and B marks are not given for fortuitously "correct" answers or results obtained from incorrect working.
 - Note: B2 or A2 means that the candidate can earn 2 or 0.
B2,1, 0 means that the candidate can earn anything from 0 to 2.

The marks indicated in the scheme may not be subdivided. If there is genuine doubt whether a candidate has earned a mark, allow the candidate the benefit of the doubt. Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored.

- Wrong or missing units in an answer should not lead to the loss of a mark unless the scheme specifically indicates otherwise.
- For a numerical answer, allow the A or B mark if a value is obtained which is correct to 3 s.f., or which would be correct to 3 s.f. if rounded (1 d.p. in the case of an angle). As stated above, an A or B mark is not given if a correct numerical answer arises fortuitously from incorrect working. For Mechanics questions, allow A or B marks for correct answers which arise from taking g equal to 9.8 or 9.81 instead of 10.



The following abbreviations may be used in a mark scheme or used on the scripts:

AEF	Any Equivalent Form (of answer is equally acceptable)
AG	Answer Given on the question paper (so extra checking is needed to ensure that the detailed working leading to the result is valid)
BOD	Benefit of Doubt (allowed when the validity of a solution may not be absolutely clear)
CAO	Correct Answer Only (emphasising that no "follow through" from a previous error is allowed)
CWO	Correct Working Only - often written by a 'fortuitous' answer
ISW	Ignore Subsequent Working
MR	Misread
PA	Premature Approximation (resulting in basically correct work that is insufficiently accurate)
SOS	See Other Solution (the candidate makes a better attempt at the same question)
SR	Special Ruling (detailing the mark to be given for a specific wrong solution, or a case where some standard marking practice is to be varied in the light of a particular circumstance)

Penalties

MR -1	A penalty of MR -1 is deducted from A or B marks when the data of a question or part question are genuinely misread and the object and difficulty of the question remain unaltered. In this case all A and B marks then become "follow through $\sqrt{}$ " marks. MR is not applied when the candidate misreads his own figures - this is regarded as an error in accuracy. An MR-2 penalty may be applied in particular cases if agreed at the coordination meeting.
PA -1	This is deducted from A or B marks in the case of premature approximation. The PA -1 penalty is usually discussed at the meeting.



JUNE 2005

GCE A, AS LEVEL and AICE

MARK SCHEME

MAXIMUM MARK: 50

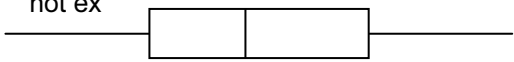
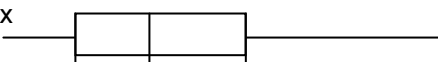
SYLLABUS/COMPONENT: 9709/06, 0390/06

**MATHEMATICS
(Probability and Statistics 1)**

Page 1	Mark Scheme	Syllabus	Paper
	A AND AS LEVEL, AICE – JUNE 2005	9709/0390	6

<p>1 $\mu = 160, \sigma^2 = 96$</p> $P(\leq 165) = \Phi\left(\frac{164.5-160}{\sqrt{96}}\right) = \Phi(0.4593)$ $= 0.677$	<p>B1</p> <p>M1</p> <p>M1</p> <p>M1</p> <p>A1 [5]</p>	<p>For 160 and 96 seen or implied by 9.798</p> <p>For standardising, must have square root</p> <p>For continuity correction, either 165.5 or 164.5</p> <p>For using tables and finding correct area (i.e. > 0.5)</p> <p>For correct answer</p>																
<p>2 (i) $5 \times 2 + 15f + 30 \times 11 + 60 \times 4$ $= 27.5(17 + f)$</p> <p>$f = 9$</p> <p>total = 26 AG</p> <p>(ii) $\sigma = 16.1$</p>	<p>M1</p> <p>M1</p> <p>A1</p> <p>A1 [4]</p> <p>M1</p> <p>A1 [2]</p>	<p>For attempt at LHS, accept end points or cl width</p> <p>For attempt at RHS, must have $17 + f$</p> <p>For correct f</p> <p>For correct answer given, ft if previous answer rounds to 9</p> <p>For method including sq rt and mean squared (can be implied if using calculator, must be x^2f on mid-points) or $\sum \frac{f(x-\bar{x})^2}{26}$</p> <p>For correct answer</p>																
<p>3 (i) $P(G, G, G, G, NG) = (0.25)^4 \times (0.75)^1$ $\times {}_5C_4$</p> $= 0.0146 \text{ AG}$ <p>(ii)</p> <table border="1" data-bbox="284 1346 746 1420"> <tr> <td>X</td> <td>0</td> <td>1</td> <td>2</td> </tr> <tr> <td>P(X = x)</td> <td>0.2373</td> <td>0.3955</td> <td>0.2637</td> </tr> </table> <p>(cont)</p> <table border="1" data-bbox="284 1518 746 1592"> <tr> <td>X</td> <td>3</td> <td>4</td> <td>5</td> </tr> <tr> <td>P(X = x)</td> <td>0.0879</td> <td>0.0146</td> <td>0.0010</td> </tr> </table>	X	0	1	2	P(X = x)	0.2373	0.3955	0.2637	X	3	4	5	P(X = x)	0.0879	0.0146	0.0010	<p>M1</p> <p>A1 [2]</p> <p>B1</p> <p>B1</p> <p>B1</p> <p>B1</p> <p>B1 [5]</p>	<p>For relevant binomial calculation, need ${}_5C_r$ or 5 or all 5 options</p> <p>For correct answer. AG</p> <p>For all correct X values</p> <p>For one correct prob excluding P(X = 4)</p> <p>For 2 correct probs excluding P(X = 4)</p> <p>For 3 correct probs excluding P(X = 4)</p> <p>All correct and in decimals</p>
X	0	1	2															
P(X = x)	0.2373	0.3955	0.2637															
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	A AND AS LEVEL, AICE – JUNE 2005	9709/0390	6

<p>4 (i) shows all the data</p> <p>(ii) Not exercise LQ = 5.4 Median = 6.5 UQ = 8.3</p> <p>(iii) not ex</p>  <p>ex</p>  <p>3 4 5 6 7 8 9 10</p>	<p>B1 [1]</p> <p>B1 B1ft B1ft [3]</p> <p>B1</p> <p>B1ft</p> <p>B1</p> <p>B1 [4]</p>	<p>Or other suitable advantage e.g. can see the shape, mode etc.</p> <p>ft on first answer missing the decimal point</p> <p>For one linear numbered scale from 3 to 9.5, or two identically positioned scales</p> <p>For not exercise all correct on linear scale</p> <p>For exercise correct on linear scale</p> <p>For two labels and cholesterol and scale labelled SR non linear scale max B0 B0 B0 B1 SR no graph paper lose one mark</p>
<p>5 (i) 618/1281 (0.482)</p> <p>(ii) 412/1281 (0.322) or tree diagram options</p> <p>(iii) $P(E) = 717/1281$</p> <p>Their (i) \times their $P(E) \neq$ their (ii)</p> <p>Not independent</p> <p>(iv) 358/564 (0.635) or (0.279/0.440)</p>	<p>B1 B1 [2]</p> <p>B1ft [1]</p> <p>M1</p> <p>M1dep</p> <p>A1ft [3]</p> <p>B1 B1 [2]</p>	<p>For correct numerator For correct denominator</p> <p>Follow through on their denominator if $p < 1$ or $2/3 \times$ their (i)</p> <p>For attempting to find $P(E)$</p> <p>For showing they know what independence means, mathematically</p> <p>ft on their (i) \times their $P(E) \neq$ their (ii)</p> <p>For correct numerator, 0.28 gets B0 with PA For correct denominator</p>

Page 3	Mark Scheme	Syllabus	Paper
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<p>6 (i) $z_1 = 0.02/0.15 = 0.1333$</p> <p>$z_2 = -0.08/0.15 = -0.5333$</p> <p>area = $\Phi(0.1333) - \Phi(-0.533)$ $= \Phi(0.1333) - [1 - \Phi(0.5333)]$ $= 0.5529 + 0.7029 - 1$ $= 0.256$</p> <p>Prob all 4 = $(0.256)^4$ (0.00428 to 0.00430)</p> <p>(ii) $z = \pm 1.282$ or 1.28 or 1.281</p> <p>$\pm 1.282 = \frac{b}{0.15}$</p> <p>limits between 1.71 and 2.09</p>	<p>M1</p> <p>M1</p> <p>M1</p> <p>A1</p> <p>A1ft [5]</p> <p>B1</p> <p>M1</p> <p>A1ft [3]</p>	<p>For standardising one value, no cc</p> <p>For standardising the other value, no cc. SR ft on no sq rt</p> <p>For finding correct area (i.e. two Φs - 1)</p> <p>For correct answer</p> <p>For correct answer, ft from their (i), if $p < 1$, allow 0.0043</p> <p>For correct z, + or - or both</p> <p>For seeing an equation involving + or - of their z, b, 0.15 (their z can only be 0.842 or 0.84 or 0.841)</p> <p>both limits needed, ft 1.77 to 2.03 on 0.842 only</p>
<p>7 (a)(i) ${}_3C_1 \times {}_5C_1$</p> <p>= 15</p> <p>(ii) ${}_5C_1 \times {}_6C_2$</p> <p>= 75</p> <p>(b)(i) $9!/2!2! = 90720$</p> <p>(ii) $5!$ Or ${}_5P_5$</p> <p>= 120</p>	<p>M1</p> <p>B1 [2]</p> <p>M1</p> <p>A1 [2]</p> <p>M1</p> <p>A1 [2]</p> <p>B1</p> <p>B1 [2]</p>	<p>For multiplying two combinations together For correct answer</p> <p>For seeing ${}_6C_2$, or separating it into three alternatives either added or multiplied</p> <p>For correct answer</p> <p>For dividing by 2! twice For correct answer</p> <p>5! seen in a numerator</p> <p>For correct final answer</p>